MVP for Blue Carbon MRV

Aldyen Donnelly,
Carbon Markets Advisor
Aldyen.donnelly@gmail.com

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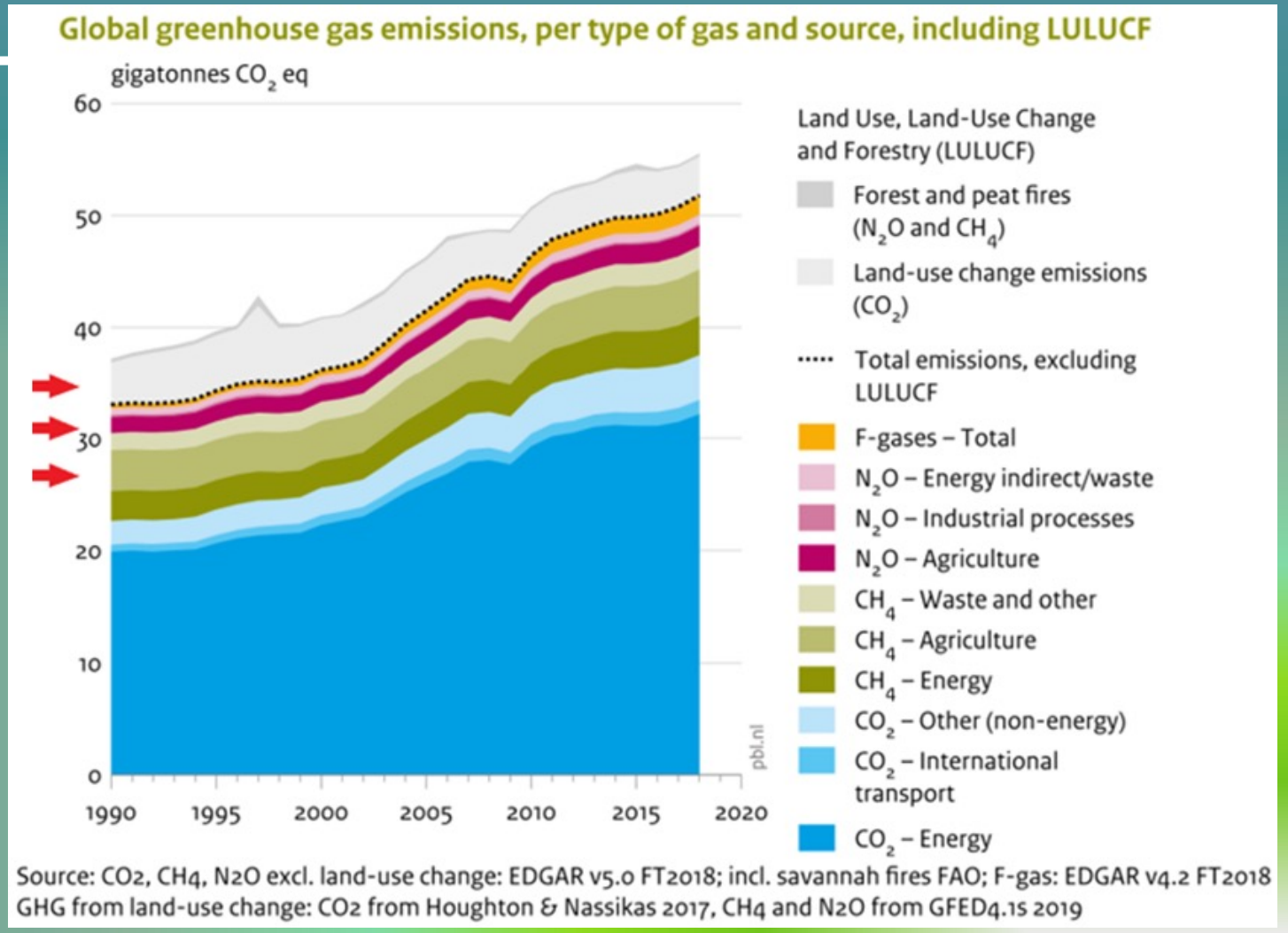
Many Thanks To:

Terramera
Nori
ALUS
New Acre Project

After 30 Years of Talking, Atmospheric Concentrations of Heat-Trapping Gases Are Still Going Up

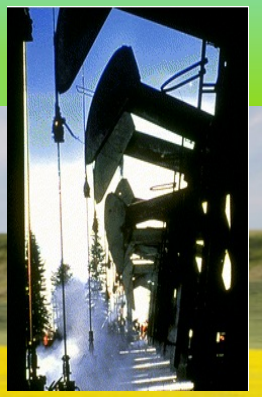
- Atmospheric concentrations of heat-trapping gases continue to grow, despite the fact that our oceans have likely sequestered ~ 7 - 10 gigatonnes (Gts) of CO2e/year, between 1992 and 2018*.
- Should we try to manage oceans to sequester more CO2, or to reduce our dependence on land for food, fibre and bioenergy…
- …or all of the above?



* Watson, *et al.*, "Revised estimates of ocean-atmosphere CO_2 flux are consistent with ocean carbon inventory", **Nature Communications 11**, September 2020

And We Are NOT on Track to Our Paris 2030 Goals

- The World Resources Institute says: “To have a medium chance of limiting warming to 1.5 degrees C, the world can release [net] another **770 GtCO2e**” into the atmosphere.
- If the world’s “Top 50” corporate GHG emitters extract, process and sell only the fossil fuels reported on their 2021 FY balance sheets as “proved reserves” —and write off their unproved reserves and stop drilling for new supply—that will result in the net addition of **810 to 940 GtCO2e** to the atmosphere.
- But over 2018-2021, the “Top 50 Emitters” spent, in aggregate, >50% of their capital spending on *more* fossil fuel exploration and development, to expand proved *and* unproved fossil fuel reserves.



Who Are We Talking About?

- **224 corps & their customers account for ~85% of man-made GHG releases. 28 state-owned and controlled entities** account for ~38% of total man-made GHG releases (n/i LULUCF). (as of 2015)
- If these state-owned entities were to exploit only their reported proved and developed oil, gas and coal reserves—and write off their unproved and proved but undeveloped reserves—they and their customers will still release an additional **~110 – 240 GtCO2e** to the atmosphere by or before 2050.

data source: CDP, "The Carbon Majors Report", 2017

	Scope 1		Scope 3		Scope 1+3	
	MtCO2e/year, as reported to the CDP project in 2017					
GHGs for Top 224 corporations in 2015	**2,965**	*9.7%*	**27,610**	*90.3%*	**30,575**	*100.0%*
of which…						
28 State-Owned Enterprises	**1,436**	*4.7%*	**12,039**	*39.4%*	**13,475**	*44.1%*
Saudi Aramco	215	*0.7%*	1,735	*5.7%*	1,950	*6.4%*
National Iranian Oil Co.	155	*0.5%*	870	*2.8%*	1,025	*3.4%*
Coal India	54	*0.2%*	971	*3.2%*	1,025	*3.4%*
Shenhua Group Corp Ltd	79	*0.3%*	922	*3.0%*	1,001	*3.3%*
China National Petroleum Corp	81	*0.3%*	544	*1.8%*	625	*2.0%*
Abu Dhabi National Oil Co.	91	*0.3%*	523	*1.7%*	614	*2.0%*
Petroleos Mexicanos	53	*0.2%*	477	*1.6%*	530	*1.7%*
Sonatrach	89	*0.3%*	404	*1.3%*	493	*1.6%*
Kuwait Petroleum Corp	43	*0.1%*	435	*1.4%*	478	*1.6%*
Qatar Petroleum Corp	73	*0.2%*	341	*1.1%*	414	*1.4%*
Petroleos de Venezuela	42	*0.1%*	366	*1.2%*	408	*1.3%*
Iraq National Oil Co	31	*0.1%*	360	*1.2%*	391	*1.3%*
Petroleo Brasileiro SA	27	*0.1%*	365	*1.2%*	392	*1.3%*
Datong Coal Mine Group	32	*0.1%*	333	*1.1%*	365	*1.2%*
China National Coal Group Co Ltd	30	*0.1%*	320	*1.0%*	350	*1.1%*
Petrolam Nasional Berhad	59	*0.2%*	281	*0.9%*	340	*1.1%*
Nigerian National Petroleum Corp	42	*0.1%*	287	*0.9%*	329	*1.1%*
Shanxi Coking Coal Group Co. Ltd	19	*0.1%*	298	*1.0%*	317	*1.0%*
Shandong Energy Group Co Ltd	24	*0.1%*	290	*0.9%*	314	*1.0%*
Shaanxi Coal Chemical Industry Group Co Ltd	23	*0.1%*	273	*0.9%*	296	*1.0%*
Poland Coal	25	*0.1%*	266	*0.9%*	291	*1.0%*
Yankuang Group CO Ltd	20	*0.1%*	236	*0.8%*	256	*0.8%*
Statoil ASA (now Equinor)	12	*0.0%*	219	*0.7%*	231	*0.8%*
TurkimenGaz	53	*0.2%*	177	*0.6%*	230	*0.8%*
Kazakhstan Coal	20	*0.1%*	203	*0.7%*	223	*0.7%*
Shanxi Jincheng Anthacite Coal Mining Group Ltd	13	*0.0%*	191	*0.6%*	204	*0.7%*
China Petrochemical Corp	23	*0.1%*	174	*0.6%*	197	*0.6%*
China National Offshore Oil Corp Ltd	8	*0.0%*	178	*0.6%*	186	*0.6%*

Who Are We Talking About?

- …and 22 publicly-traded or privately-held entities account for a further ~22% of man-made GHG releases. (2015)
- If these entities were to exploit only their reported proved and developed oil, gas and coal reserves, stop exploring for more, and write off their unproved and proved but as yet undeveloped reserves, they and their customers will release an additional ~**700 – 800 GtCO2e** to the atmosphere by or before 2050.

	Scope 1		Scope 3		Scope 1+3	
	MtCO2e/year, as reported to the CDP project in 2017					
22 Publicly Traded or Privately Held	**638**	*2.1%*	**7,259**	*23.7%*	**7,897**	*25.8%*
Gazprom	108	*0.4%*	1,090	*3.6%*	1,198	*3.9%*
Rosneft OAO	83	*0.3%*	694	*2.3%*	777	*2.5%*
ExxonMobile Corp	54	*0.2%*	523	*1.7%*	577	*1.9%*
Royal Dutch Shell	48	*0.2%*	460	*1.5%*	508	*1.7%*
BP PLC	28	*0.1%*	420	*1.4%*	448	*1.5%*
Peabody Energy Corp	10	*0.0%*	387	*1.3%*	397	*1.3%*
Chevron Corp	36	*0.1%*	341	*1.1%*	377	*1.2%*
Glencore PLC	36	*0.1%*	287	*0.9%*	323	*1.1%*
Lukoil	3	*0.0%*	325	*1.1%*	328	*1.1%*
BHP Billiton Ltd	27	*0.1%*	290	*0.9%*	317	*1.0%*
Total SA	20	*0.1%*	293	*1.0%*	313	*1.0%*
Arch Coal Inc.	7	*0.0%*	225	*0.7%*	232	*0.8%*
Eni SPA	23	*0.1%*	208	*0.7%*	231	*0.8%*
ConocoPhilips	24	*0.1%*	199	*0.7%*	223	*0.7%*
SUEK Ltd	18	*0.1%*	200	*0.7%*	218	*0.7%*
Henan Coal Chemical Industry Group Co Ltd.	18	*0.1%*	197	*0.6%*	215	*0.7%*
Anglo American	5	*0.0%*	210	*0.7%*	215	*0.7%*
Jizhong Energy Group Co Ltd	19	*0.1%*	194	*0.6%*	213	*0.7%*
Surgutneftegas OAO	20	*0.1%*	193	*0.6%*	213	*0.7%*
Bumi Resources	18	*0.1%*	182	*0.6%*	200	*0.7%*
Kailuan Group Co Ltd	17	*0.1%*	175	*0.6%*	192	*0.6%*
Shanxi Lu'an Mining Group Ltd	16	*0.1%*	166	*0.5%*	182	*0.6%*

"Scope 3" includes only consumer end-use GHGs for products refined & retailed by named company

The Soils and Seas: Our Only Current Climate Risk Management Options

- It’s going to take time to achieve significant, real net reductions in global anthropogenic GHG releases to the atmosphere
- Investing in roots, shoots and microbes on land and in marine coastal ecsystems are our only short-term options.
- C sequestration project financing can be secured even when long-term C sequestration values are associated with large uncertainties.
- Financing won’t be available if the financial community cannot see credible uncertainty estimates.

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To Attract Financing, All C Sequestration Projects Must Deliver Co-Benefits

All policies, measures and ecosystem service market initiatives we do implement must *coincidentally* draw heat-trapping gases out of the atmosphere, *and* secure at least one—ideally more than one—of:

- **Nutrient dense food supply**
- **Sufficient clean water supply**
- **Accessible, safe shelter**
- **Energy security**
- **Easy human access to recreation sites**

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DIsclose Uncertainty and We Can DO Deals

Learn from the example of weather derivatives…

. “**Weather derivatives** are financial instruments that can be used by organizations or individuals as part of a risk management strategy to reduce risk associated with adverse or unexpected weather conditions.

The first weather derivative deal was in July 1996 when Aquila structured a dual-commodity hedge for Consolidated Edison. The transaction involved ConEd's purchase of electric power from Aquila for the month of August. The price of the power was agreed, and a weather clause was embedded into the contract. This clause stipulated that Aquila would pay ConEd a rebate if August turned out to be cooler than expected. The measurement of this was referenced to Cooling Degree Days (CDDs) measured at New York City's Central Park weather station. If total CDDs were from 0 to 10% below the expected 320, the company received no discount to the power price, but if total CDDs were 11 to 20% below normal, ConEd would receive a $16,000 discount. Other discounted levels were worked in for even greater departures from normal.”

(Wikipedia)

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Greenhouse Emissions Management Consortium Press Release:

GEMCo Members Agree to Buy Emission Reduction Credits From Iowa Farmers

Washington, DC - October 19, 1999 – The Greenhouse Emissions Management Consortium (GEMCo), a consortium of Canadian energy companies focusing on market-based ways of reducing greenhouse gas emissions, today announced an agreement with IGF Insurance Company, the fourth largest crop insurer in the US, to buy at least 2.8 million metric tons of carbon dioxide-equivalent emission reduction credits. Seven consortium members will participate in the agreement which will run through 2012.

The announcement was made during the third annual fall conference of the Emission Marketing Association, a trade association of companies involved in emissions trading.

The agreement is a first of its kind in that it applies to a broad spectrum of agricultural sources for carbon dioxide emission reduction credits, or CERCs. IGF intends to solicit the CERCs from eligible farmer/landowner participants through its network of crop insurance agents, initially from Iowa, and ultimately nationwide...

A CERC is defined as the equivalent of one metric ton of atmospheric carbon dioxide (CO_2) or other greenhouse gas measured in CO_2-equivalents, reduced or avoided from an agreed baseline. CERCs are generated by documenting activities that cause measurable incremental increases in soil carbon and/or the actual reduction of carbon dioxide, methane or other greenhouse gas emissions. CERCs may eventually be surrendered by title holders to environmental regulators, in partial compliance with possible future legislated obligations to reduce greenhouse gas emissions. Alternatively, CERCs could be packaged with a wide range of energy or food products to achieve an emissions-neutral market offering...

So What Was MVP for MRV, in This Context?

- This purchase agreement had a 10-year term.
- It included 11 schedules, one for each regen ag action land owners could choose to implement. What is the Blue Carbon equivalent?

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So What Was MVP for MRV, in This Context?

- The parties agreed to a best-existing science-based estimate of the min, max, mean and standard deviation (95% confidence level) of the GHG reduction or net sequestration potential of each possible land use, soil treatment, manure management or irrigation practice change.
- The credit buyers agreed to pay for 50% of mean estimated credits upon receipt of verified proof that practice change had been implemented.
- Buyers agreed to a floor + market index price for verified credit claims.
- In exchange for payment for claims based on 50% of the estimated mean CO2 reduction or sequestration value of the practice change, suppliers committed to comprehensive data reporting, which they must update annually, for at least 10 years.

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So What Was MVP for MRV, in This Context? (cont.)

- Suppliers had no obligation to adopt new MRV procedures.
- But the contract stipulated that in the event that a supplier adopted a more advanced MRV procedure, and that procedure revealed that they had reduced or sequestered more CO2 than they had initially been paid for, they could put the CO2 credit difference to the buyers, to receive payment equal to the base + market-indexed credit price in the year of the put.
- In theory—and practice—the proliferation of contracts like this establish the potential for real return on investment in more advanced MRV and related research.

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What Does This Mean for Blue Carbon?

- Focus, for now, on the development of replicable estimates of min, max, mean and standard deviation for CO2 sequestration potential for marine coastal Blue Carbon opportunities, especially when the Blue Carbon projects can be located with or near desalination, offshore wind and solar projects or that are focussed on marsh and Mangrove recovery.
- Publish credible research roadmaps for MRV with the potential to reduce uncertainty.
- Investors will see the profit potential in investments in advancing MRV techs and capacity.
- DON'T jump to techs/methods promising "more precision" before we can estimate uncertainty!

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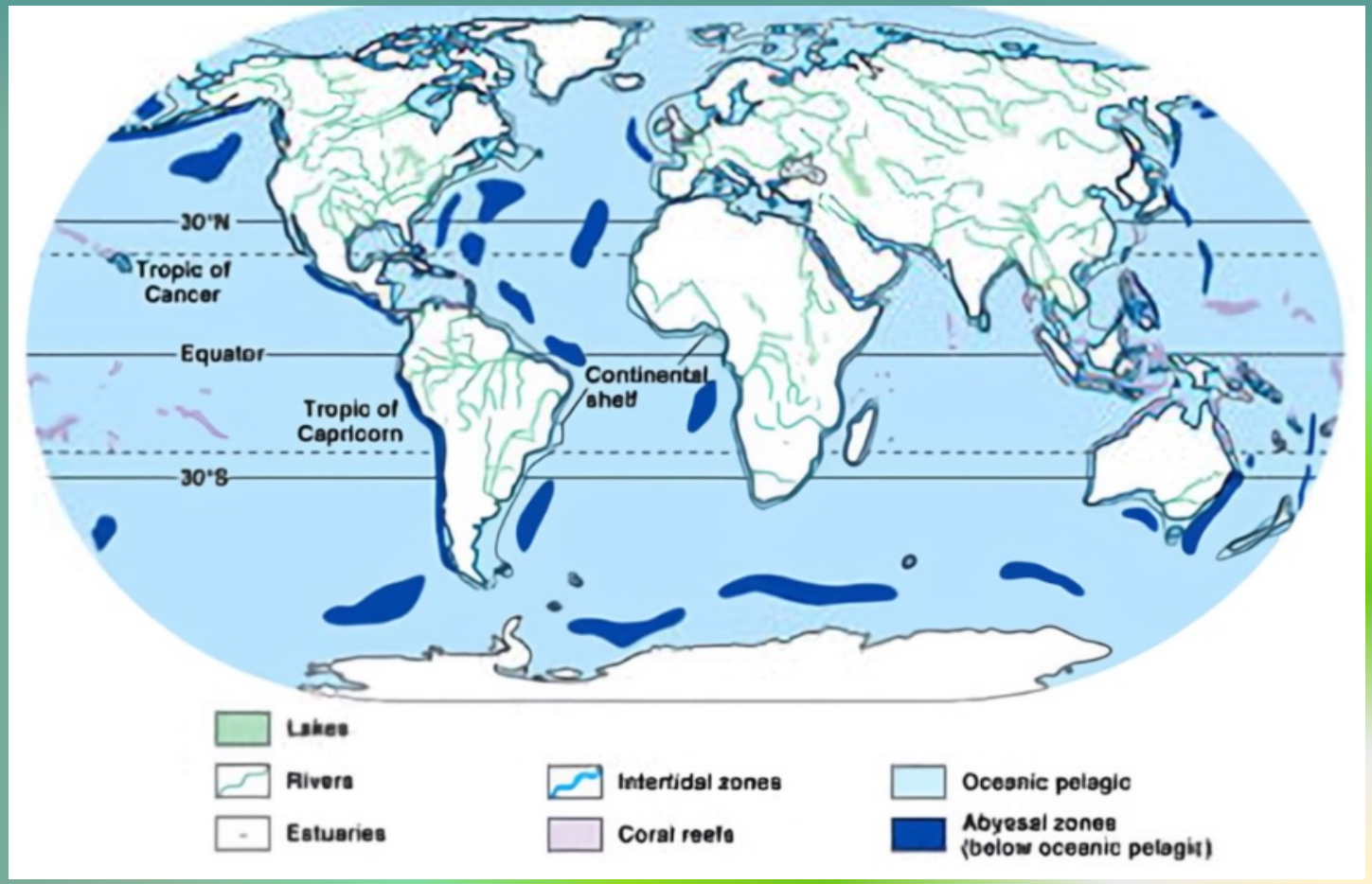
Where Can We Store More C in Ag Soils?

- Soil carbon stocks in the top 30 cms of global soils can be recovered to historic levels at rates typically ranging from 0.3 to 1.0 TCO2e/acre/year.
- That translates into theoretical **global potential to draw a net ~4Gt to ~15Gt/year out of the atmosphere, every year, over 200-300 years**.
- But it will take >10 years to work up to a global soil sequestration rate of -4GtCO2/year, let alone -15GtCO2e/yr.
- So we must look to "Blue Carbon" protection, restoration and creation for ***at least -10GtCO2e/yr***, by 2030.

Note that when 0.0272 tonne of C is added to terrestrial SOC stocks, 1 TCO2e is drawn out of the atmosphere.

Where Can Build Blue Carbon Stocks?

- Tbd…where is the greatest potential? Where should we go first?
- Important background: organic carbon stocks in above ground biomass and sediment to 100 cm varied significantly between habitat types, from saltmarsh (90 t ha^{-1}), to mangrove (46 t ha^{-1}), to seagrass (27 t ha^{-1}) and unvegetated habitats (26 t ha^{-1}). Despite being typically overlooked in blue carbon literature, unvegetated habitats contained the majority of estuarine carbon stocks when adjusted for their large extent within the estuary (occupying 68.4% of the estuarine area and containing 57% of carbon stocks). When carbon stocks were further refined based on $\delta^{13}C$ and $\delta^{15}N$ mixing model results, coastal vegetation (saltmarsh, mangrove, and seagrass) was found to provide important cross-habitat subsidies of carbon throughout the estuary, including contributing an estimated 41% of organic carbon within unvegetated sediments, and 51% of the total carbon stock throughout the estuary (yet occupying only 31.6% of the estuary).



About the Question of “Permanence”

Tbd…

Main point – no compliance carbon market in the world requires regulated emitters to prove avoided terrestrial C extraction or incremental terrestrial C retention, let alone permanent C sequestration.

Why is there a permanence standard for natural systems solutions when there isn’t even a terrestrial C stock gain standard for engineered systems?

Table 9-1: Product-Based Emissions Efficiency Benchmarks

NAICS Sector Definition	NAICS code	Activity (a)	Benchmark (B_a)	Benchmark Units
Crude Petroleum and Natural Gas Extraction	211111	Thermal EOR Crude Oil Extraction	0.0811	Allowances / Barrel of Oil Eqv. Produced Using Thermal EOR
		Non Thermal Crude Oil Extraction	0.0076	Allowances / Barrel of Non Thermal Crude Oil Eqv.
		Natural Gas Processing ≥ 25 MMscf/day	0.0220	Allowances / Barrel of Gas Processed Eqv.
Natural Gas Liquid Extraction	211112	Natural Gas Liquid Processing	0.0118	Allowances / Barrel of Natural Gas Liquids Produced
Potash, Soda, and Borate Mineral Mining	212391	Mining and Manufacturing of Soda Ash and Related Products (through vintage 2018 allocation)	0.948	Allowances / Short Ton of Soda Ash Equivalent (Soda Ash, Biocarb, Borax, V-Bor, DECA, PYROBOR, Boric Acid, and Sulfate)
		Mining and Manufacturing of Soda Ash and Related Products (vintage 2019 allocation and beyond)	1.13	Allowances / Short Ton of Soda Ash Equivalent
		Mining and Manufacturing of Borates (vintage 2019 allocation and beyond)	0.595	Allowances / Short Ton of Boric Oxide Equivalent

California Cap&Trade Regulation, page 171.